

ABSTRACT

Methods and apparatus are provided for extreme ultraviolet phase shift masks. The apparatus comprises a substrate, a reflectance region, and an attenuating phase shifter. The reflectance region overlies the substrate. The attenuating phase shifter overlies the reflectance region. The attenuating phase shifter includes a plurality of openings that expose portions of the reflectance region. The attenuating phase shifter attenuates radiation through a combination of absorption and destructive interference. The method comprises projecting radiation having a wavelength less than 40 nanometers towards a mask having a plurality of openings through an attenuating phase shifter. The plurality of openings expose a reflectance region in the mask. The attenuating phase shifter is less than 700 angstroms thick. Radiation impinging on the reflectance region exposed by said plurality of openings is reflected whereas radiation impinging on the attenuating phase shifter is attenuated and shifted in phase. The attenuating phase shifter attenuates using absorption and destructive interference.